

Life-cycle Assessment and Life-cycle Thinking

for Performance Track Members

Performance Track Teleseminar
January 26, 2005

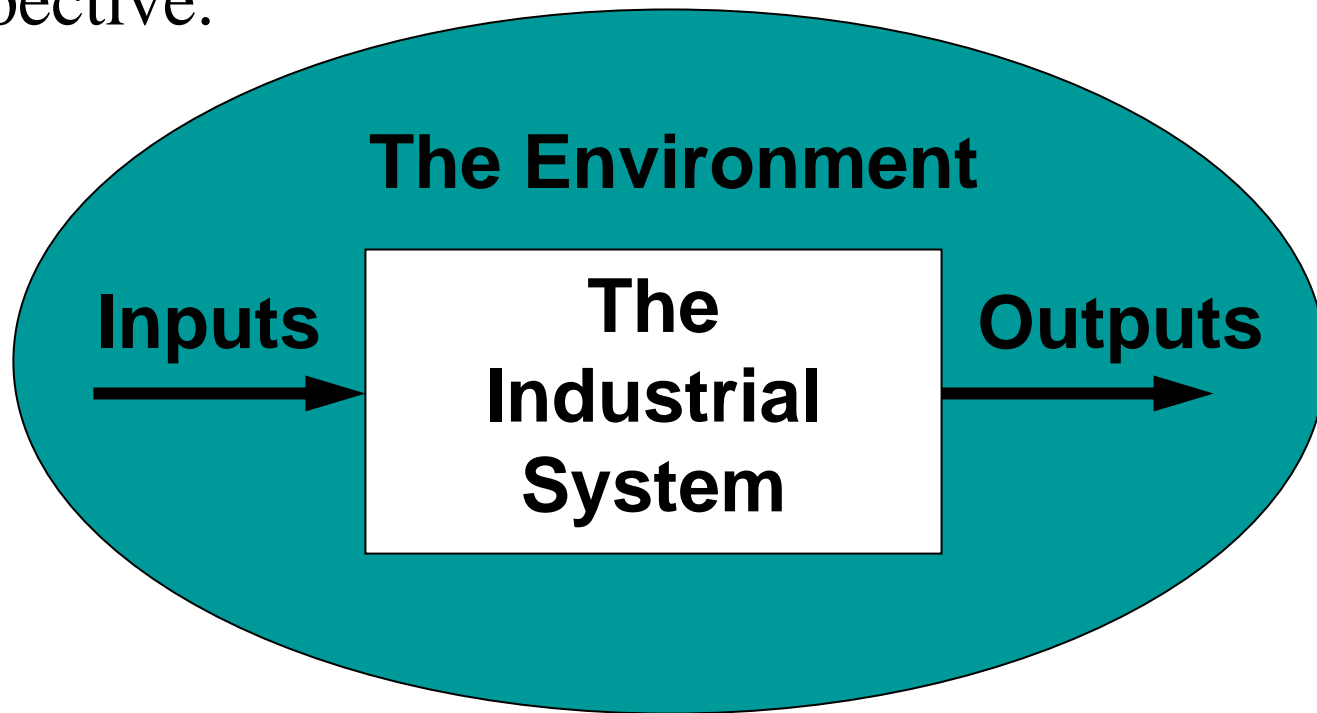
Solving problems, guiding decisions – worldwide

Maria Leet Socolof
Senior Scientist/Associate
maria_socolof@abtassoc.com
301-347-5344



The Life-cycle Concept

Industrial systems are comprised of interdependent processes and activities, requiring a systems approach for considering technology from a “cradle-to-grave” perspective.

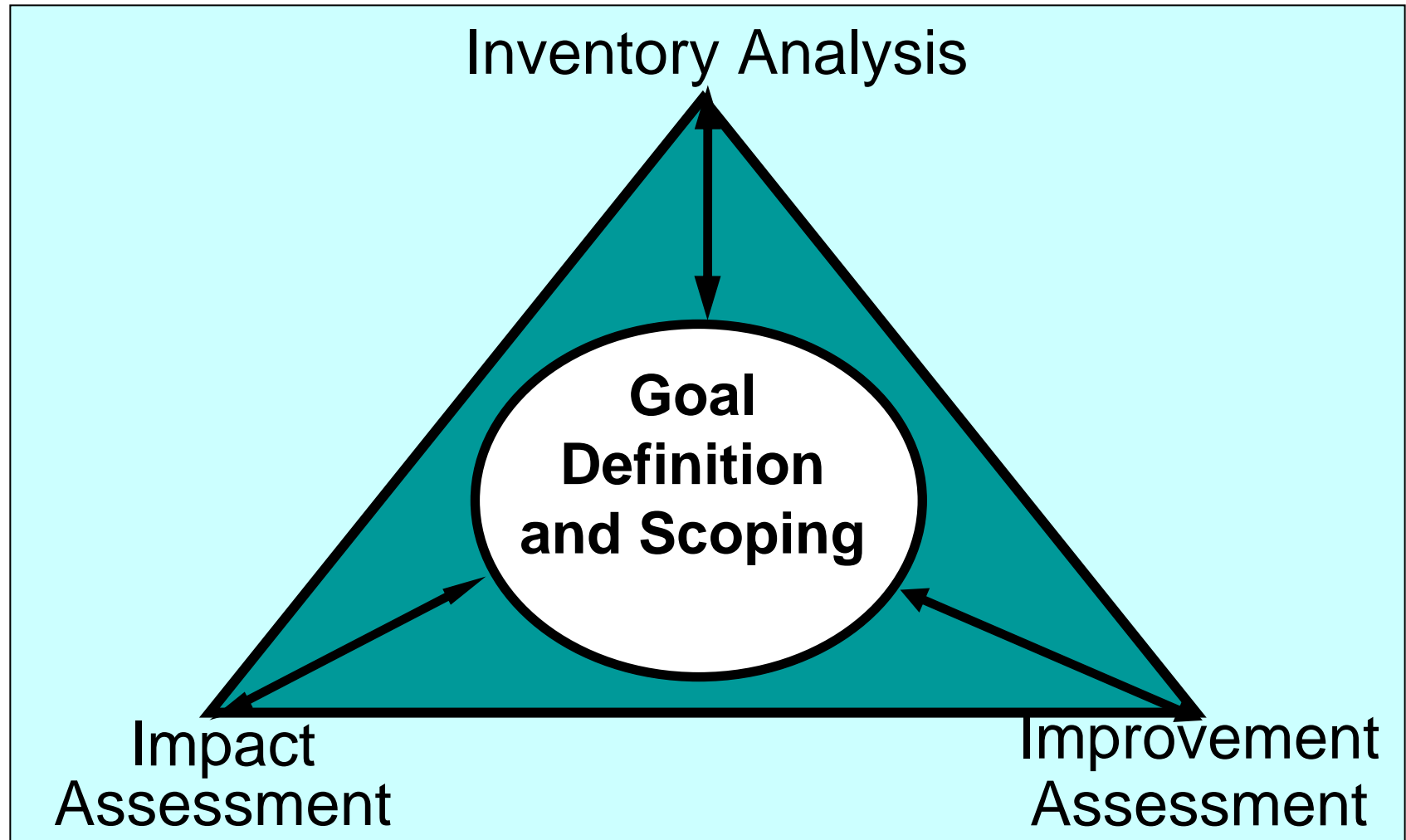


Life-cycle Assessment

LCA is a holistic analytical technique for assessing the environmental effects associated with a product, process, or activity.

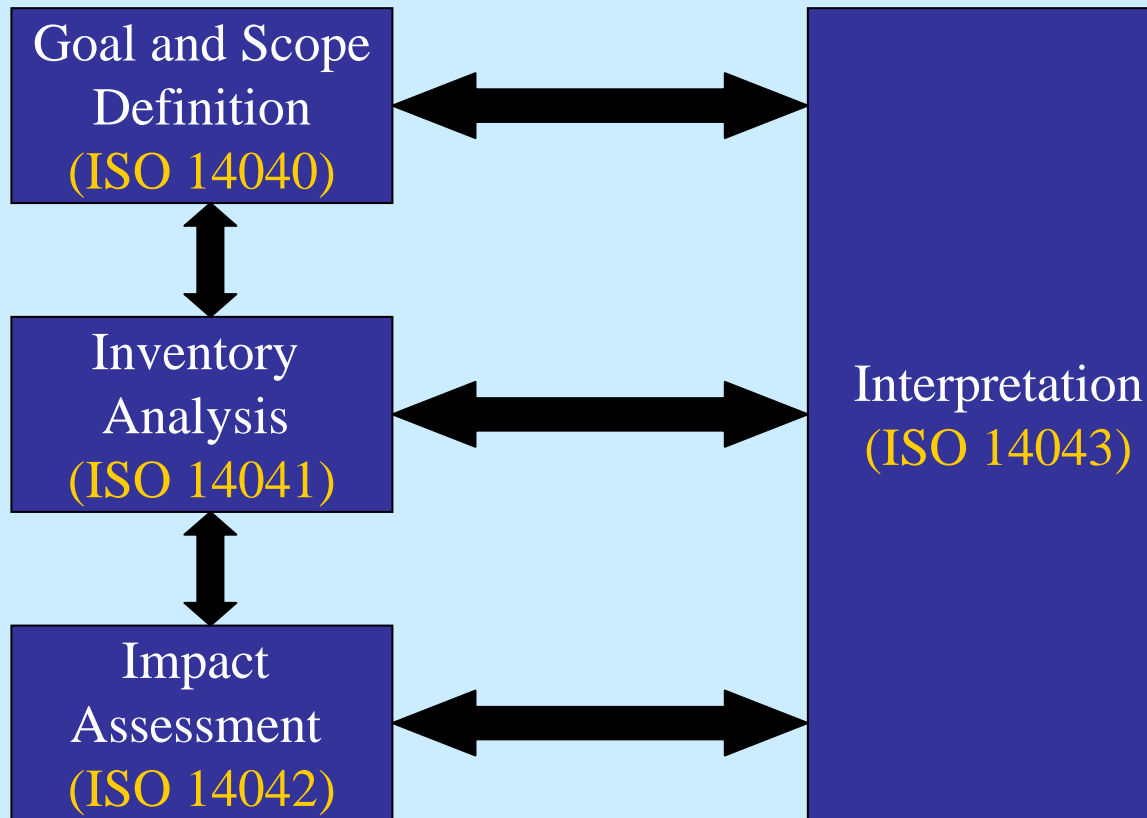
- System-wide, multi-media perspective
- Functional unit accounting system
- Comparative assessment of relative or functional unit differences

LCA Conceptual Framework: SETAC Definition

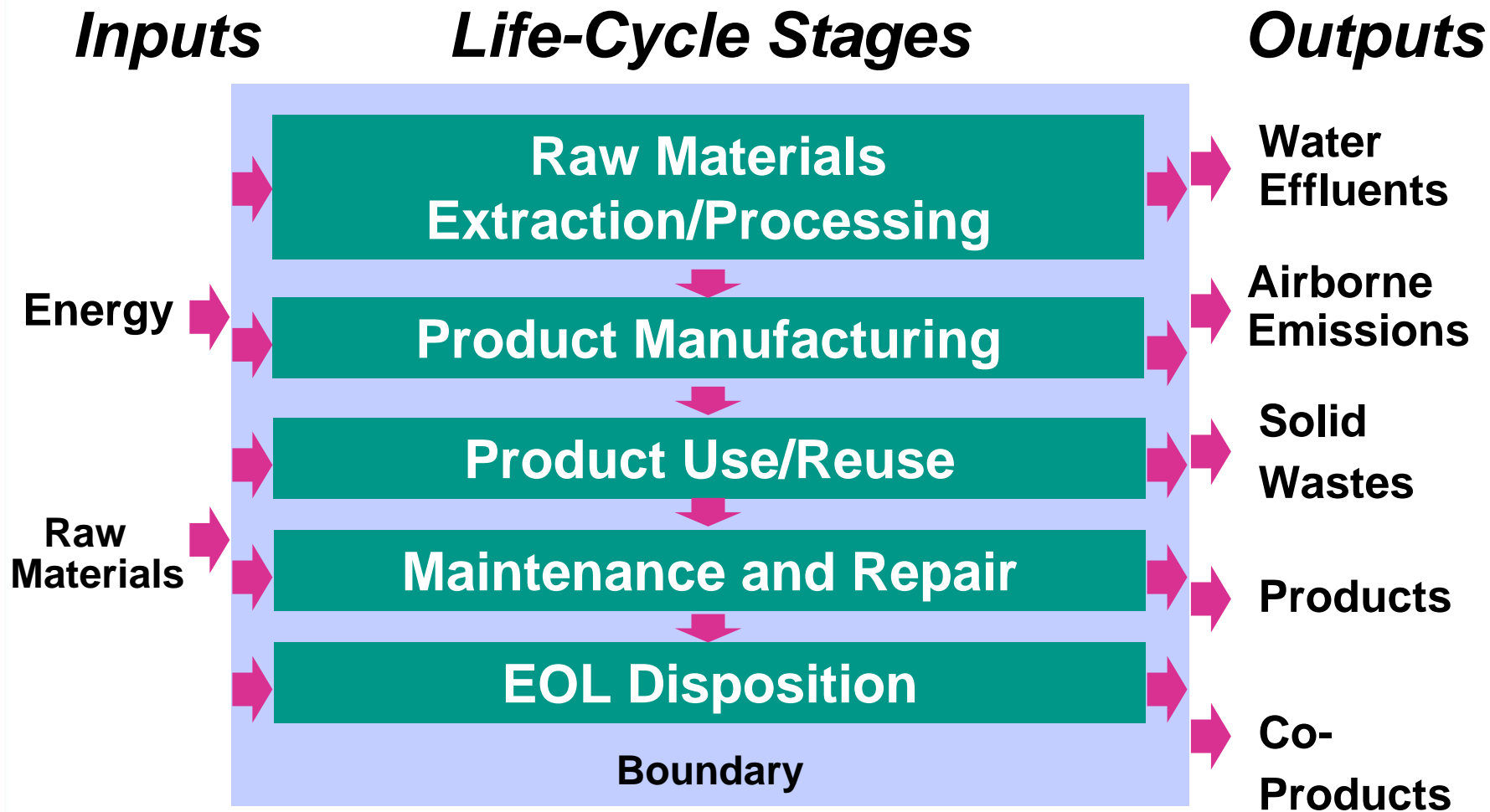


ISO 1404x Definition of LCA

Life-Cycle Assessment Framework



General Scope of LCA



Importance of LCA

- Better decision-making for product/production systems
- Identifies key impacts and life-cycle stages of system
- Provides a basis for environmental improvements of system
- Identifies trade offs
- Identifies information gaps

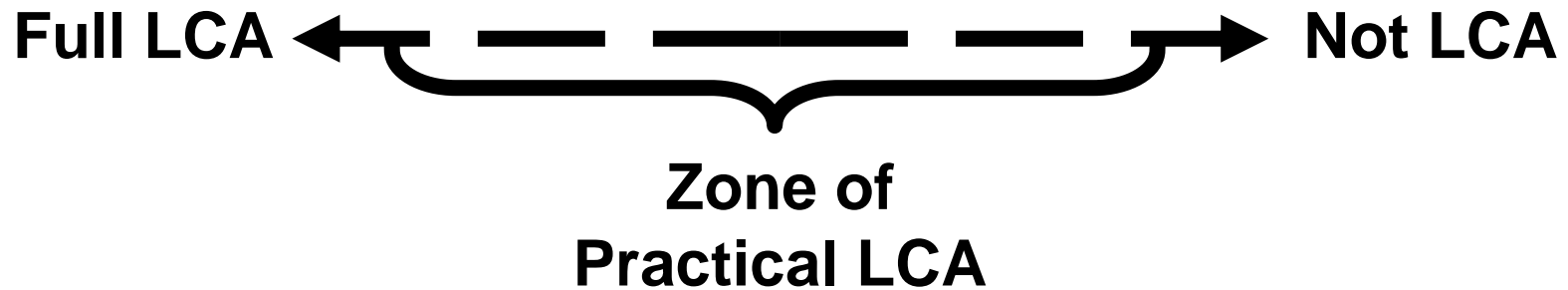
Applications of LCA

- Internal to Producers/Marketers
 - product or process design/redesign
 - materials selection
 - life-cycle management
 - strategic planning
- External to Producers/Marketers
 - environmental labeling
 - environmental procurement
 - public policy

Limitations of LCA

- Availability and quality of life-cycle inventory data
- Uncertainties in the inventory and in the impact assessment methodology
- Lack of agreement on some elements of Impact Assessment methodology
- Differences in LCA problem formulation due to differences in values

Spectrum of LCA

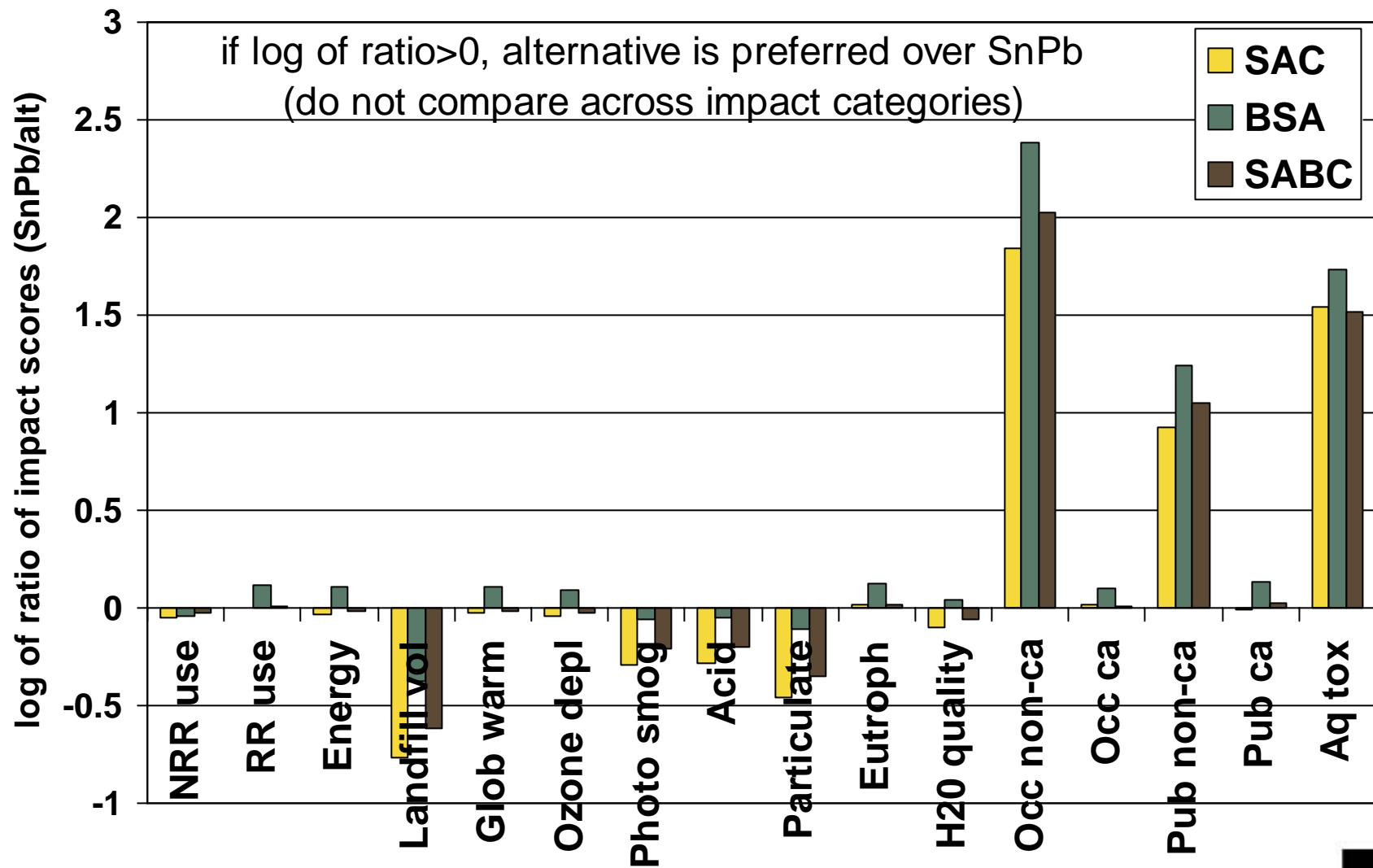


- “Gate-to-gate” or “cradle-to-gate” = often scope for facilities (not true LCA)
- “Cradle to grave” = traditional LCA
- “Cradle to cradle” = current/evolving LCA

Focus of LCAs

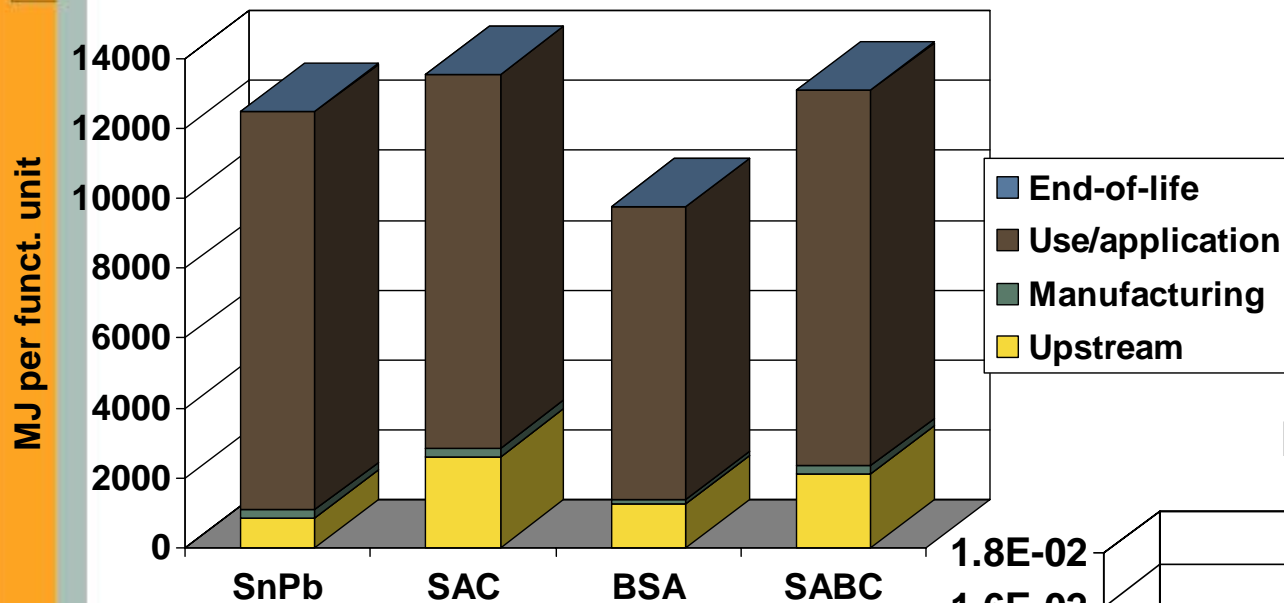
- LCAs are often product-based
 - Cloth vs. disposable diapers
 - Paper vs. plastic packaging
 - CRT vs. LCD monitors (EPA DfE)
 - Lead vs. lead-free solders (EPA DfE) – examples provided
- Less common, yet still applicable are process- or activity-based LCAs (which can include facility-based LCA)
- Example types of LCAs:
 - Baseline
 - Comparative
 - Streamlined (relates back to goals and scope)

Product LCA Results (Paste Solder): Lead-free vs. lead solder relative differences

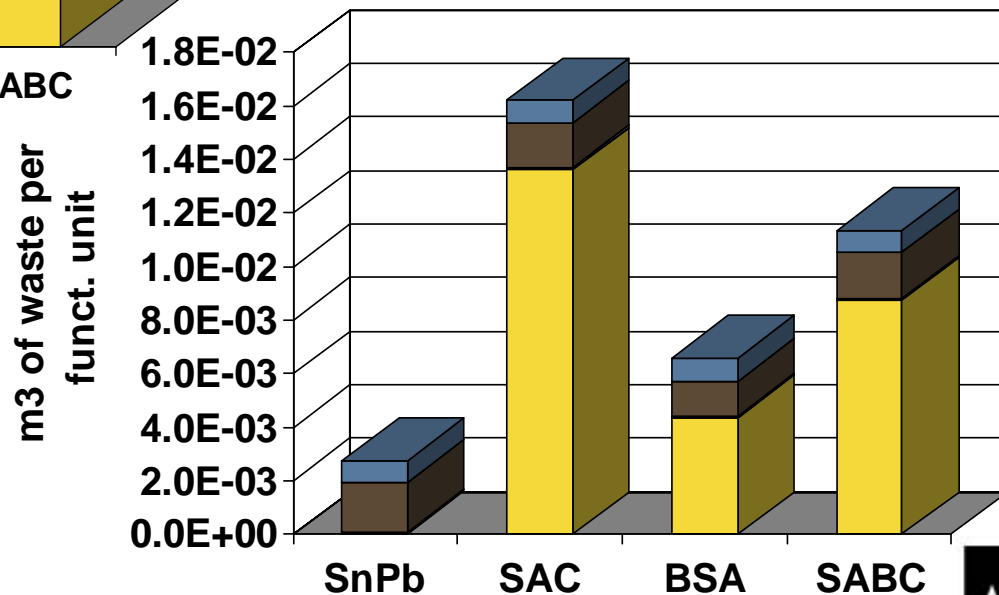


Selected Impact Category-specific Lead-free Solder Results

Energy Use



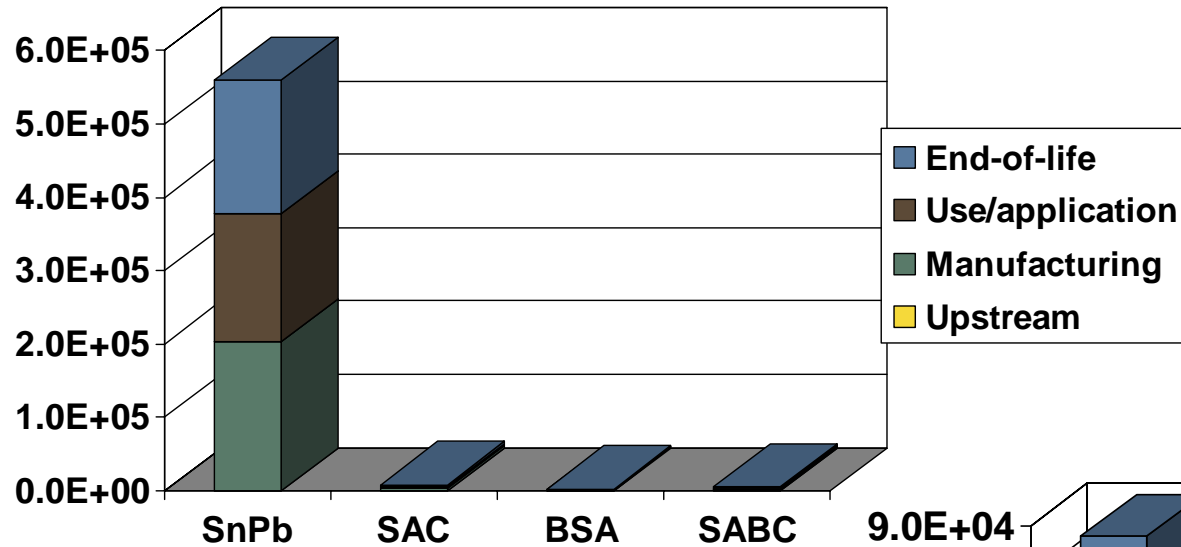
Landfill Space Use



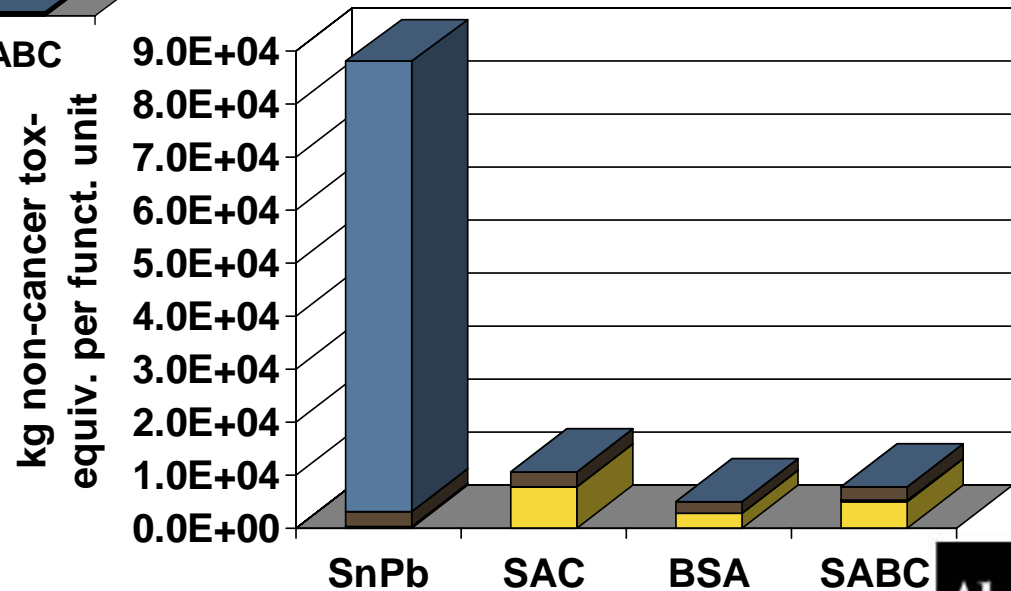
Selected Impact Category-specific Lead-free Paste Results

Occupational Non-cancer

kg non-cancer tox-equiv. per funct. unit



Public Non-cancer



Summary of Major Life-cycle Stages: Lead-free Paste Solder Results

Impact category	SnPn	SAC	BSA	SABC
NRR use	Use	Use	Use	Use
RR use	Use	Use	Use	Use
Energy use	Use	Use	Use	Use
Landfill space	Use	Upstream	Upstream	Upstream
Global warming	Use	Use	Use	Use
Ozone depl.	Use	Use	Use	Use
Photo. smog	Use	Upstream	Use	Use
Acidification	Use	Upstream	Use	Use
Particulates	Use	Upstream	Upstream	Upstream
Eutrophication	Use	Use	Use	Use
Water quality	Use	Use	Use	Use
Occ. non-cancer	EOL/Use	EOL/Use	EOL	EOL/Use
Occ. cancer	Use	Use	Use	Use
Public non-cancer	EOL	Upstream	Upstream	Upstream
Public cancer	Use	Use	Use	Use
Aquatic ecotoxicity	EOL	Upstream/EOL	EOL	EOL

Facility-based Life-cycle Thinking

- Upstream (“Cradle”)
 - Supply chain management (suppliers’ environmental performance)
 - Procurement (e.g., green labels)
- Inside the facility (within the “Gate”)
 - Materials/resource use from facility processes/activities (e.g., reduced toxics, reduced energy, etc)
 - Emissions/outputs from facility processes/activities (e.g., reduced air emissions)
- Use and end-of-life (“Gate to Grave”)
 - Use stage (if product) (e.g., extended life)
 - EOL services
 - waste management
 - Recycling (cradle to cradle)

Application to Performance Track

- Continue and expand life-cycle thinking into environmental performance goals
 - Upstream (e.g., suppliers, procurement)
 - Downstream (customers, EOL service providers)
- Conduct facility-based LCAs
 - Evaluate baseline activities to identify key impacts and key life-cycle stages
 - Evaluate alternative materials, products, or processes for process/procedural modifications within the facility/company
 - Identify greatest life-cycle impacts to help target goals and maximize environmental improvement/benefit



THANK YOU!